

STS-98 ORBITER POST LANDING INSPECTION
Debris Assessment
21 February, 2001

After the 12:33 pm local time landing on 20 February, 2001, a preliminary post landing inspection of OV-104 Atlantis was conducted at the Edwards Air Force Base Runway 22. The final inspection was performed at the Mate Demate Device (MDD) on February 21, 2001.

The Orbiter TPS sustained a total of 102 hits of which 13 had a major dimension of one inch or larger. This total does not include the numerous hits on the base heat shield attributed to SSME vibration/acoustics and exhaust plume recirculation.

The following table lists the STS-98 Orbiter damage hits by area:

	<u>HITS > 1-inch</u>	<u>TOTAL HITS</u>
Lower Surface	8	73
Upper Surface	1	5
Window Area	3	18
Right Side	1	1
Left Side	0	3
Right OMS Pod	0	2
Left OMS Pod	0	0
TOTALS	13	102

The Orbiter lower surface sustained 73 total hits, of which 8 had a major dimension of one inch or larger. Approximately 24 damage sites (with three larger than one inch in a major dimension) were located in the area from the nose gear to the main landing gear wheel wells. The amount and size of damage in this region was less than average. ET intertank TPS venting modifications appear to continue to have a reducing effect on both the quantity and size of the damage sites.

Numerous damage sites around the LH2 ET/ORB umbilical were most likely caused by pieces of the umbilical purge barrier flapping in the airstream and contacting tiles before pulling loose and falling aft.

The largest lower surface tile damage site, located just aft and outboard of the nose landing gear door, measured 2.5 inches long by 2 inches wide by 0.25 inch deep. Slight erosion was observed at this and an adjacent damage site. Imbedded in a third damage site in this area was a fibrous material believed to be Ames gap filler.

The second largest hit was located on the lower surface of the left-hand inboard elevon, and measured 2 inches long by 1.5 inches wide by 0.5 inch deep. This damage site showed indications of thermal erosion.

Only two minor hits were observed on the left OMS pod. However, two adjoining edges of an AFRSI blanket near the leading edge of the left OMS pod were observed to be

loose and frayed. There were no missing tiles or blankets from the OMS pods that would coincide with the debris observed near the OMS pod prior to SRB separation in film E-207.

There were no tiles or blankets missing from the vertical tail. The vertical tail leading edge damage site observed during on-orbit operations had not changed significantly (2 inches by 3 inches by 0.25 inch). This damage site appeared to have an impact residue embedded in it. It is planned to remove this residue for further analysis.

This is the first flight using the forward up-firing RCS jet plumes to help prevent BSM particulate impingement on the windows during SRB separation. Window hazing appeared to be less than normal. Streaks were observed on forward facing windows 3 and 4. The streaks are believed to be RTV adhesive used to bond the paper covers to the Orbiter RCS nozzle exits. It was also noted that an AFRSI blanket was slightly protruding from the area immediately aft of the up-firing jets in the forward RCS group.

A total of 18 impact damage sites on the window perimeter tiles were observed with three having a major dimension of one inch or greater. These damage sites are a result of impact by RCS paper covers with RTV adhesive on the back.

The landing gear tires were reported to be in good condition. There was no ply under cutting on the main landing gear tires.

No debris was found beneath the umbilicals after the umbilical doors were opened.

Tile damage on the base heat shield was typical. The SSME Dome Heat Shield closeout blankets were in excellent condition, except for the SSME number one closeout blanket which was torn at the seven-o'clock position.

A post landing walk-down of the runway was performed. No flight hardware was found. All components of the drag chute were recovered and appeared to have functioned normally. Both reefing and line cutter pyrotechnic devices were expended.

In summary, both the total number of Orbiter TPS debris hits (120) and the number of hits one inch or larger (13) were well within established family (family average 98 total hits and 16 one inch or greater). Potential identification of debris damage sources for mission STS-98 will be based on the laboratory analysis of Orbiter post landing microchemical samples, inspection of the recovered SRB components, film analysis and aerodynamic debris particle trajectory analysis. The results of these analyses will be documented in the STS-98 Debris/Ice/TPS assessment and the Integrated Photographic Analysis Report.

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